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Northwestern Division



Effects of Bonneville Dam Spillway Operations on Fish Passage

Water Quality Team Briefing

12 June 2007



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Presentation Format

- Configuration and Operation Changes
- Effects of Spill on Adult Fish Passage
- Spill Passage Efficiency
- Survival



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Operational and Structural Changes

2000 Construction of new JBS at PH2

2001 Powerhouse priority shifted from PH1 to PH2

2002 Flow deflectors installed and/or modified

- End bays (1-3 & 16-18) with deep deflectors (7' msl)
- Middle bays (4 – 15) with shallow deflectors (14' msl)
- New spill patterns developed

2003 Installation of the corner collector at PH2

2003 Removed PH1 juvenile bypass screens

2005 Recalibrated spillway gate openings

2006-07 New Spill Operations Tested

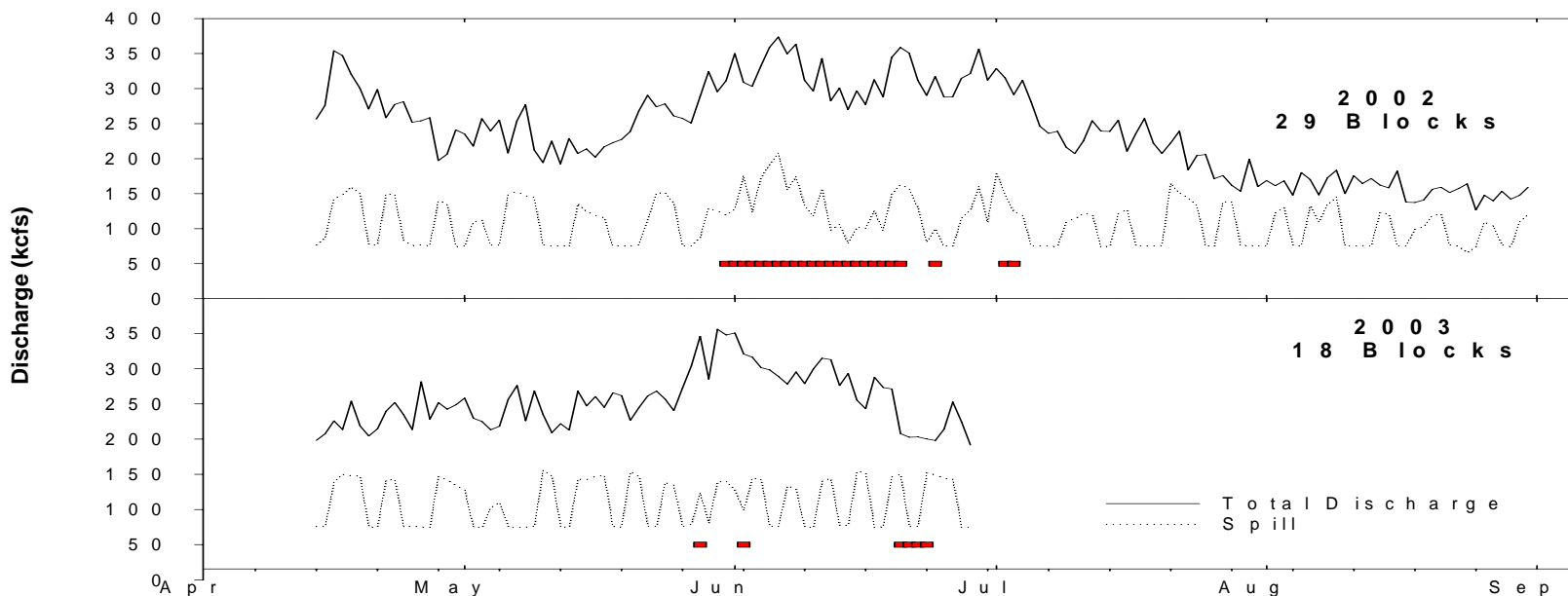


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Adult Fish Passage Study 2002 & 2003

- 75 Kcfs daytime spill vs. gas cap spill
 - Counts
 - Passage times





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Adult Fish Passage Study – Fish Counts

- 2002: Higher passage (2:1 or greater ratio) during low spill ($T = 3.03$, $P = 0.01$).
- 2003: Higher passage during low spill ($T = 3.02$, $P = 0.008$).
- Much higher passage through Cascades Ladder during low spill ($T = 5.15$, $P = 0.0001$).



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Adult Fish Passage Study – Passage Times

From tailrace to:

	Low	High	P	n	delay (hr)
• First approach	0.29	0.47	0.007	17	4.32
• First entry	0.71	1.05	0.006	16	8.16
• Pass dam	1.27	1.86	0.006	16	14.16



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Adult Passage Study

- Fallback % during Hi spill greater than during Lo spill (8 vs. 2%), $p < 0.04$ based on condition at time of fallback.
- BON Spillway Model Evaluations found large backflows just below the spillway and heavy turbulence near fishway entrances when spill levels were at or above 120 kcfs.
- 2003 Spillway antennae show more fish enter spillway during Hi spill but no increase in entrance use.



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Adult Fish Passage Study

Conclusions:

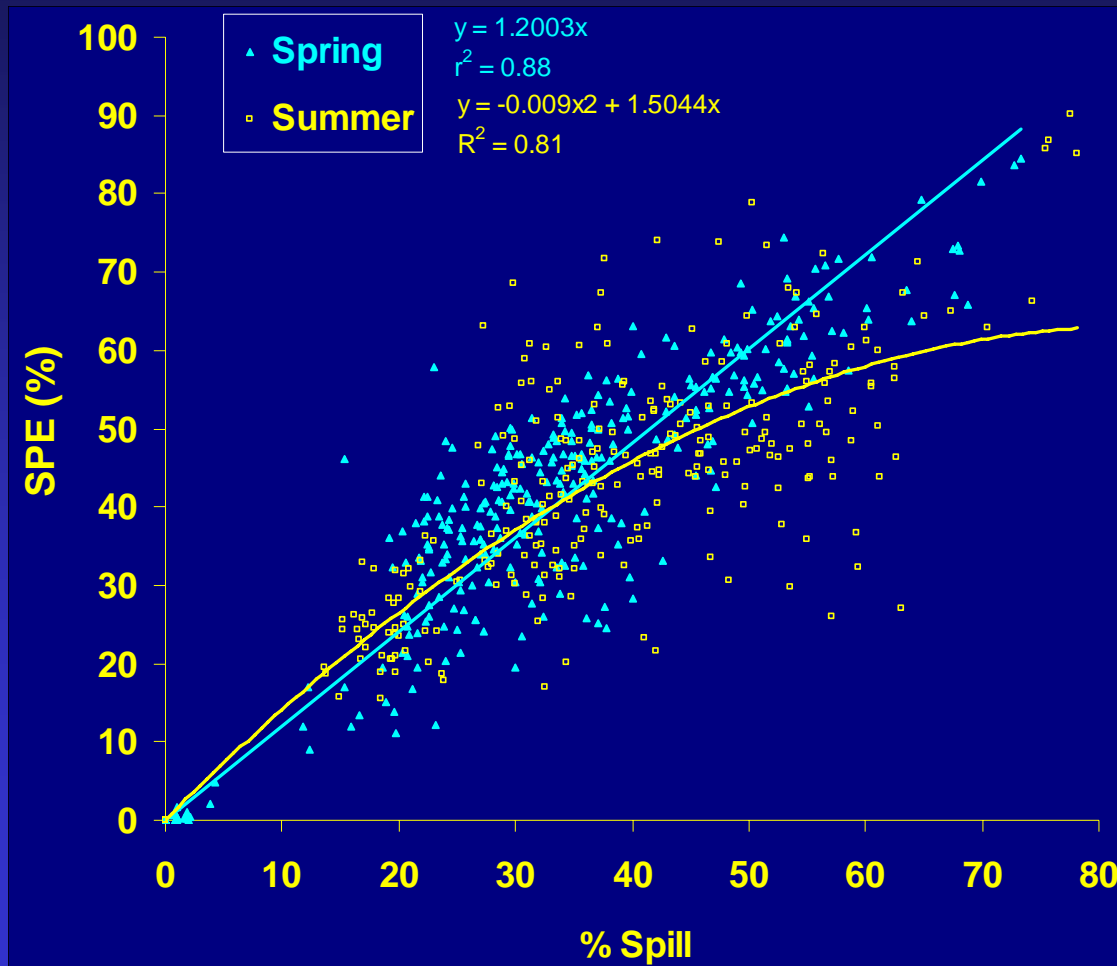
- High spill levels are detrimental to adult passage at Bonneville Dam (passage time and fallback).
- In 2006 region set limit on controlled spill of 100 kcfs based on this study.



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Effect of Percent Spill on Spill Passage Efficiency





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Spillway Survival

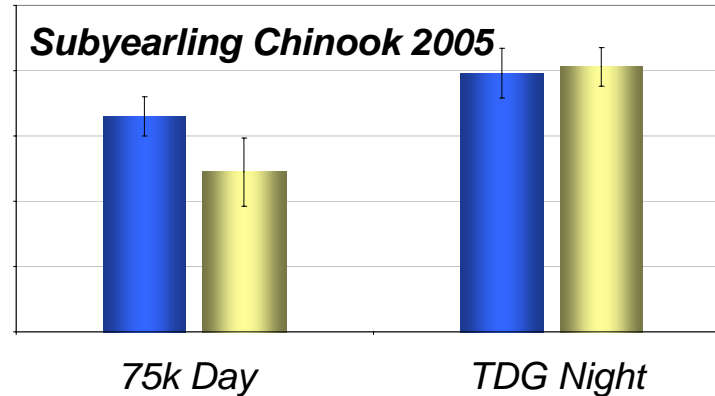
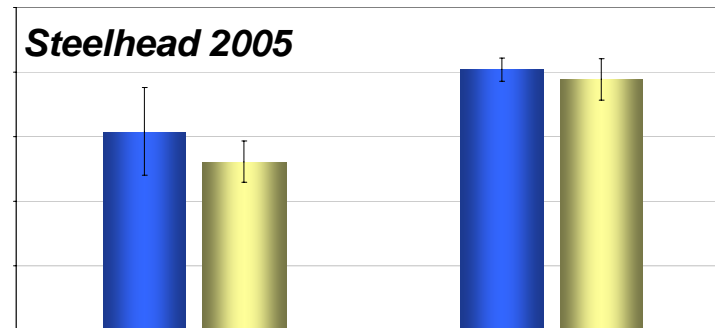
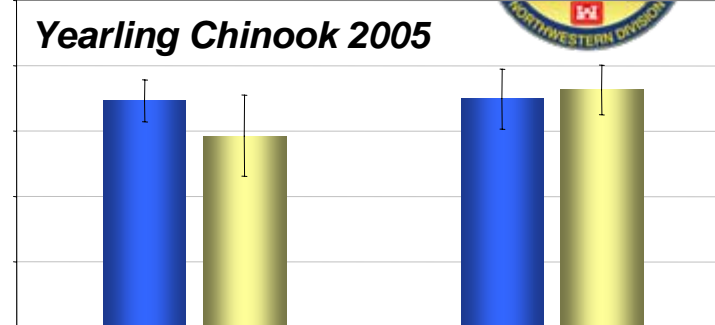
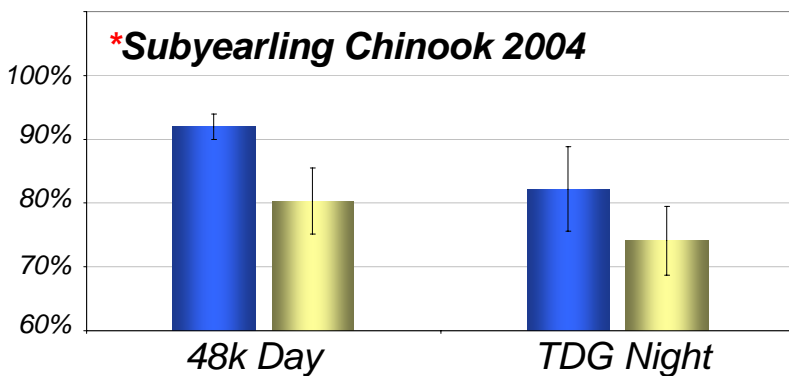
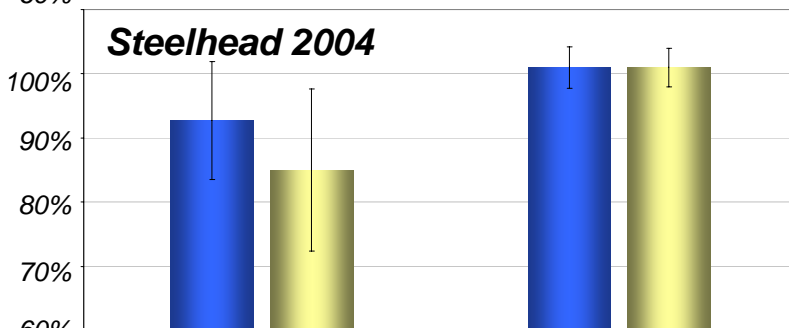
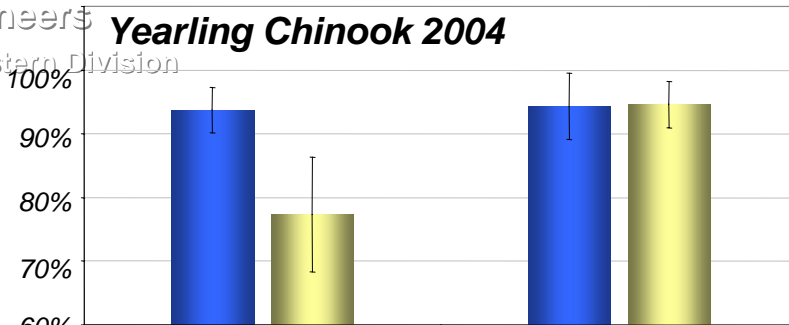
Year	CH-1	STHD	CH-0
2000	98%	-----	-----
2002	98%	-----	-----
2004	91%	98%	87%
2005	91%	96%	91%
2006	94%	-----	86%



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Spillway Passage Survival



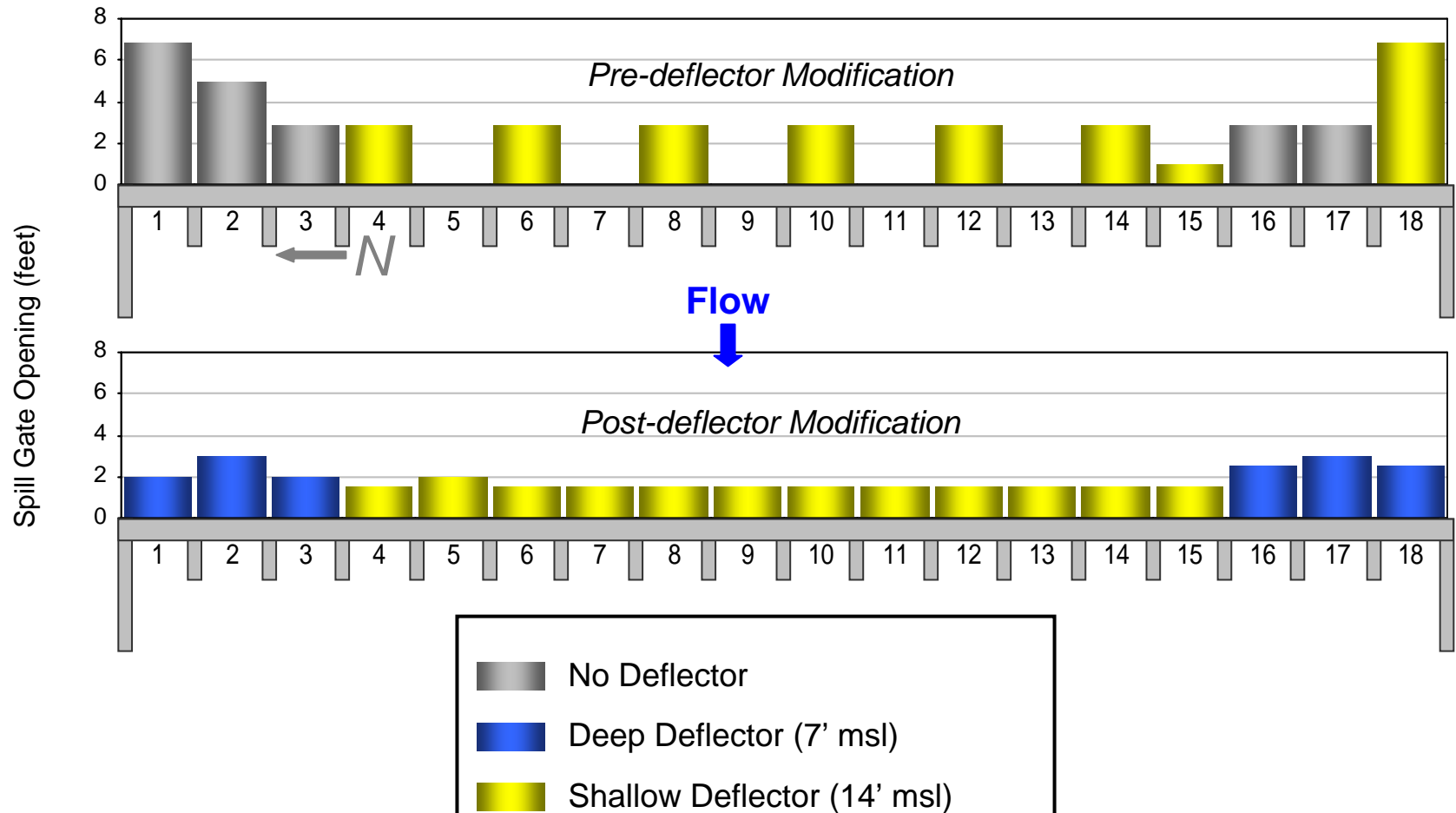


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Spill Patterns

75 KCFS SPILL





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2006 and 2007 Studies

- 2006 – Developed new spill patterns for spring and summer with 2' min. gate opening.
 - Spring: 100 Kcfs 24-hours per day
 - Summer: 75 Kcfs day/ gas cap night
- 2007 – Revised '07 patterns to address TDG performance. Evaluating daytime survival, 14' vs. 7' deflectors.



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Summary

- Spill above 100 Kcfs during the daytime delays adult migrants and increases their fallback rates,
- Spill passage efficiency is approximately 1:1,
- Survival of juvenile fish that pass through the spillway is low for Chinook, particularly during the daytime, under lower Q, and through bays with shallow deflectors.



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Path Forward

- Evaluate direct effects of passing specific locations and/or operations on smolt injury and mortality
 - Deflector elevation?
 - Gate opening?
 - Erosion?
- System-wide spillway injury study
 - Identify spillway conditions that result in injury
 - Develop spillway design criteria for safe fish passage